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ABSTRACT

The role of organized research in Texas higher education is examined with emphasis on the relationship of research to teaching and learning, the quality of academic programs, and the needs of the state and its citizens. University utilization of research funds are reviewed in four areas. These areas include state planning, educational improvement, management of natural resources, and protection of the environment and its peoples. (MJM)

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The Critical Role of Organized Research in Texas Higher Education

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cb **Study Paper 13**

Coordinating Board, Texas College and University System
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Quality Teaching Depends Upon Research

Research is an integral part of university education; it is the primary activity which keeps the content of education current, pertinent, and challenging to college students. Cultural stagnation would set in quickly if one generation of teachers was content to teach only what it had been taught. Each generation must add to the learning it has received; the means to that addition is research.

A university, concerned as it must be with the quality of its instruction and with the true educational service which it provides, is keenly aware of the quality and scope of research carried on by its faculty. University professors find it very difficult to remain abreast of new developments and to be effective in the teaching and training of students unless they are allowed to pursue research in their fields of interest. In case after case, those professors chosen by students as outstanding teachers are those who have consistently been involved in meaningful research and are intimately involved with the discovery and interpretation of new knowledge.

The novelty, the excitement, and the vitality of superb teaching are not possible at the university graduate level unless the teacher is also a researcher. Every great university in the world offers living proof of this truth.

Any quality graduate program requires unwavering commitment of university resources to the support and encouragement of research. Research activity by graduate students, under faculty supervision, is the heart of the graduate teaching-learning experience. The pace of development not only of science and technology but also of the social sciences and other fields of inquiry is such that the university professor cannot depend upon last decade's or even last year's understanding of his subject. Without first-hand experience and knowledge of what is happening *now* in his field, he cannot remain an authority or effectively lead young people. Among those faculty members who are sometimes criticized by both the public and students as being irrelevant are often those who have lacked sufficient opportunity to engage in research activities in their areas of competence.

In the past the most active fields of research in this country have been engineering, physics, chemistry, space, astronomy, biology, aeronautics, electronics, computer sciences, etc. However, during the past few years it has become increasingly obvious that while great strides have been made in technical fields, the nation has been paying too little attention to important areas such as environmental quality, population growth, transportation, housing and urban development, oceanography, and others. In view of past neglect, it now becomes all the more urgent that universities begin rapidly to develop new research competence in these areas.

Society has learned that technological and industrial change are almost inevitably accompanied by social unrest and human upheaval; and for this reason, research in humanistic and social problems must go hand in hand with investigation of scientific and technological areas.

How Universities Put Research Funds To Work

. . . To Help State Planners

Population Studies: Organized research funds are used to publish yearly population estimates for the 254 counties of Texas, to prepare projections by county for 1975, 1980, 1985, and 1990 and beyond to 2010, and to analyze population trends in Texas, drawing particularly on the 1970 census results.

The Aging Population: The aging constitute a larger and larger percentage of the total population. Studies of their social and economic characteristics, demographic trends, and medical and psychological needs are necessary to intelligent and effective provisions for their care. Decisions relative to the commitment of state resources to aging citizens will rely heavily on accurate information derived through research. The Social and Rehabilitation Service of the Department of Health, Education, and Welfare has recognized the need on a national scale.

Rehabilitation of the Handicapped: Research into rehabilitation systems which return handicapped individuals to productive places in society and maintain their feelings of dignity has increasing significance. The benefits of the results of the research to the state can be best measured in terms of the value placed by Texans on all individuals, regardless of their physical or mental condition.

Traffic Violators: Street and highway safety is a major state and national concern. Differential insurance rates testify to the concentration of the problem in the teen-age population. Law enforcement records show that a segment of that population consists of chronic traffic violators. The information sought in this research relates to the identification of potential chronic violators and ways by which they may be helped to become responsible, safe drivers.

Shorter Work Week—Longer Work Day: A change in working hours to longer days and a shorter week could have widespread effects on society, especially on required changes in education, transportation needs, urban development, recreational trends, legislative changes, etc. Results of study on those effects would be most meaningful to the state in determining long range plans for corrective action to counter any adverse effects which a move to more leisure time would produce. A meaningful contribution can be made to the solution of an important future problem.

Income Tax Problems Peculiar to Texas: Since Texas is one of only eight states which follow the community property system of ownership of marital property, most tax research has been concentrated on problems arising in the so-called common-law states. A study of income tax problems peculiar to Texas and other community property states is underway. The results, which will be published in one or more law review articles, will be of great value to attorneys, their clients, accountants, and all Texas citizens to help them comply with, and take advantage of tax-saving opportunities, in federal tax statutes.

. . . To Improve Education

Instructional Improvement: Research in computer-assisted instruction has led to a major national project designed to produce more cost-effective undergraduate instruction. Using the new program design techniques with new computer concepts, this project seeks to provide instruction at less than $1.00 per hour in high-volume freshman and remedial courses.

Educational Applications of Technology: A study of innovations in electronic communications technology has been done for the Texas Education Agency. Trends in the development of electronic telecommunications technology are identified, and in turn are interpreted relative to state educational programs. Projections have been made for the next 20 years and priorities for educational applications have been explored.

Bilingual Problems Identified: The Texas Public School System may benefit from a bilingual program that has resulted from a comparison study of English and Mexican Spanish. The bilingual problem is a critical one in many areas of the State, and a successful application of this solution is being investigated. Officers of the U.S. Office of Education/Office of Spanish Speaking Americans are utilizing some of the conclusions of this study in their deliberation about a national bilingual program for the United States.

Oral History Collection: The significance of this research lies in the preservation by recorded interviews, of the memoirs of Texans who have made significant contributions, who have occupied key points of decision making, who have been instrumental in setting taste or opinion, or who have been witness to significant events, whether by chance or by position. The recorded interviews preserve, without editorial comment or judgment, source material for Texas history and government, and contribute to the preservation of the Texas heritage.

Testing New Concepts Depends Upon Organized Research

State appropriations are not the sole resource upon which universities draw to support research. Yet those appropriations, often amounting only to a fraction of the total effort, may be the most important. Federal agencies and private foundations have, for many years, been committed to the support of research at universities. To attract the interest and support of private foundations and federal research programs, the plans and objectives of research projects must stand the test of critical review. They must be clearly feasible ideas for investigation, based on encouraging findings. Here is where "Organized Research" funds appropriated by the state are so valuable. Many research investigations are begun, only to be changed when the early findings require a modification of objective or method.

We must continue to have some way, even on a modest scale, to try out ideas, to see whether real benefits are likely to accrue, before we can hope to attract industrial, governmental, or foundation financing to expand the investigation of these ideas and their applications. Each institution of higher education in Texas has a number of significant research opportunities suitable for investigation given sufficient organized research money; and each of these institutions is now achieving less than its full research potential.

Out of such basic ideas, generated in the academically oriented research laboratory, have resulted such real and long-lasting benefits to the people of Texas as the eradication of the screw worm, improved varieties of grain sorghums, improved methods of producing petroleum, and newly developed petrochemicals and plastics. The cost of the basic "feasibility research" leading to such significant findings is thus returned to the people manyfold. An important corollary to the research results of such programs, from the point of view of long-term benefits, is the fact that young persons who work in the research with qualified professors are later able to make, on their own, contributions and developments which may also prove to be extremely valuable.

Continued Economic Development Is Dependent Upon Research

Underlying the economic structure of the State of Texas is a scientific-technological sophistication of the highest order. Life in Texas, within the last twenty years, has moved to a level of dependence on technology, knowledge and information which now ranks it with New York, Massachusetts, and California among the leading research-based states in the United States. It is fortunate that, within the state universities of Texas, there exist faculty members with the research capability, training, and interests to provide for the people of the State of Texas expertise which can support the State's continuing technological development.

New methods for effective business operations derive from research pertaining to all aspects of commerce. New people trained to serve in tomorrow's business are taking part in research today as our university students.

Such natural systems as our Gulf Coast, our forest belts, our deserts, our arid high plains and many others must be better understood through research into all parts of the environment if our plans for development are to be more than temporary periods of success followed by permanent disaster and waste.

In past years there has grown up around the graduate research universities in the United States a concentration of private, research-based, technologically oriented industry. High-income, high-technology industries are attracted to localities where universities with research competence exist. Both industries and the Federal government consider the proximity of good universities in the selection of sites for new laboratories and offices. The opportunity for this kind of economic growth has not been fully realized in Texas, and continued research is necessary for it.

. . . To Help Texas Industries

VEE: Venezuelan Equine Encephalomyelitis invaded Texas during the summer of 1971, killing over 1,600 horses and infecting over 1,900 horses and 88 people. Organized research funds made it possible to initiate research essential to the control and prevention of the disease in Texas. As a result of demonstrated competence to provide needed information, federal contracts have been awarded for additional VEE studies. The significance of the research to the sizeable horse industry in Texas cannot be overestimated.

Gulf Coast Shrimp: Preliminary studies on shrimp culture indicate that a third, or winter growing season may be possible in South Texas. The potential of a third growing season is of great significance economically to the lower Texas coast since the shrimp would be placed on the market when consumer demands are highest. Also, a study of the nutrition of Gulf Coast shrimp is underway. Knowledge of the substances on which the shrimp larvae thrive is essential to the successful "farming" of shrimp, which is done extensively abroad but is still in an experimental stage in the U.S.

Caterpillar Control Using Biological Agents: Controversy over use of insecticides has stimulated search for alternative methods of insect control. Management of predatory wasps for caterpillar control has shown promise in experiments conducted since 1970. They are employed in a manner somewhat analogous to use of honey bees for crop pollination and honey production, and in some cases principles and techniques developed by apriculturis for use with bees have proved useful. These experiments hold promise of putting a new environmentally sound weapon in man's arsenal for use against his insect enemies.

Irrigation With Low-Grade Water: Techniques for using moderately salty (high sodium) irrigation water on problem soils are being tested. These techniques hold promise for lower costs per unit agricultural production and better utilization of otherwise marginal soils and water.

Game Farming For Profit: A continuing series of studies of the role of wildlife in ranch mangement in Texas is beginning to reveal how ranchers can increase immediate and long term profits by managing more for wildlife than for cattle, without losing the benefits of either.

Crude Oil Toxicity For Cattle: The question of whether crude oil is toxic to cattle and, if so, in what amounts, has plagued cattle growers and oil men in Texas for years. An extensive study of the problem of utilizing Texas crude oil has delineated the amounts and types of petroleum products that do produce toxicity in cattle and has demonstrated the signs and lesions produced in oil toxicity. This information, in turn, allows veterinarians to make an accurate diagnosis when cattle are, or are not, poisoned by oil.

Cattle Diseases: Research on Anaplasmosis, a serious cattle disease occurring commonly in large areas of the State, and causing sporadic heavy losses, has led to the development of an immunization which is effective in controlling the disease for extended periods of time. The potential reduction of livestock losses as a result of the vaccine is of great significance to the cattle industry in Texas.

. . . To Attack Dread Diseases

Cancer Research: Cancer research has successfully developed prototypes of a class of anti-leukemic agents that have been recognized as *the* most promising developments in that field. Its importance has been acknowledged by the continuing support the program now recevies from the National Cancer Institute. Also, mice have been cured of leukemia by means of nontoxic combination of drugs. Further research and tests on primates may ultimately lead to a cure for acute lymphocytic leukemia in children.

Development of New Drugs and Antibiotics: An important new class of potential antitumor and antivirial drugs has been developed which relates directly to human health care in the state. Also, fungal diseases which are potentially fatal to humans are combatted by antibiotics. These antibiotics are now being synthesized and modified to make them more effective in fighting disease.

Cardiac Disorders: Heart research is directed at many possible causes of heart disorders. Information already available indicates the presence of certain isoenzyme forms in varying degrees in different organs of the human body. Research is underway to determine whether a difference in the isoenzyme patterns can be detected between normal and diseased hearts. A valuable diagnostic tool for the detection of cardiac disorders will be made available if such a difference can be established.

Biochemical Research: Biochemical research is providing an understanding of life in molecular terms. This knowledge is essential for the diagnosis, treatment, and prevention of disease and for optimal development of man and his environment. Major advances have been made toward understanding the etiology of diseases such as cancer and the regulation of myriad body functions. Some evidence has been developed that indicates that chemicals produced by cancerous cells cause normal cells to become cancerous. These chemicals when released into the blood stream may stimulate noncancerous cells in any part of the body to become cancerous, and then in turn produce more of the chemical. Confirmation of this evidence and identification of the chemical would provide a significant step toward the treatment of cancer.

University-Based Research Serves State Agencies

The State of Texas also is confronted with a number of serious economic, technological, environmental, social and political problems. The solutions to many of these problems await sophisticated research before political leaders of the State can make plans and decisions on the basis of sound information.

The various State agencies responsible under the constitution and by statute for specific areas of concern have not built the large, expensive research facilities necessary for problem-solving in a technological age. Rather, they have made extensive use, through interagency contracts, of university facilities such as computer centers, highway research centers, water resource research centers, business research bureaus, population research centers, and others. If the State of Texas does not continue to depend upon and to support these university-based research efforts, it will be necessary to build and staff such facilities within other areas of the government structure.

The research work carried on in our universities retains a vast potential for improving the quality of life of the people of Texas with a minimum of costly duplication.

Efficient Use of University Resources Depends Upon Stability Of Funding Organized Research

Research at a university does not lend itself readily to rigid time schedules because the solution of individual problems proceeds at different rates. Further, the most significant research is usually open-ended and cannot be planned in terms of one-year, two-year, or three-year research problems. Thus, a professor may follow a certain line of investigation for a few years, a decade, or a career.

Financial support must be as stable as can be provided. There is an inherent waste involved and an even greater loss in trying to reassemble workers, materials, or interest, once a program has been abandoned. Assembling a team of researchers to work together on some interdisciplinary project, given time constraints on each team member, is not an easy task in itself.

Instruction of students is the primary mission of universities, and the complicated scheduling of the instruction must be planned for first. In assigning faculty time and effort, sudden changes—whether owing to cancellation of expected research funds or to sudden new research opportunities—may cause wasted manpower. Research may be delayed or opportunities lost if it is not integrated into the regular routine of faculty work planning. Hence, only reasonable continuity of research funding allows for the *effective* planning necessary for best results. Off-on, start-stop research programs leave great residues of surplus equipment, disappointed hopes, and unfinished efforts—all of which are expensive, wasteful, and damaging.

Provision of modest but solid and continuing financial support for research and graduate study, will provide for continuation of what must be regarded as an essential part of the total program of graduate education in Texas.

Federal requirements of "matching funds", and "institutional cost sharing" must be met, even though only small numbers of dollars are involved when compared to the federal share. Organized Research dollars are desperately needed to meet these requirements, since there are no other institutional funds to provide flexibility in responding to research opportunity.

A capability for high-quality research normally develops gradually over a period of years, with a steady expansion of research facilities, staff, and students.

Some stability of funding for activities must be provided, if adequate graduate institutions are to be developed and maintained. State funds are essential to this purpose.

. . . To Manage Natural Resources

Municipal Water Supplies: There is scarcely any problem of greater long-range significance to Texas than that of maintaining an adequate fresh water supply. Total annual rainfall, when subjected to the annual evaporation rate, is known to be insufficient to accommodate domestic and industrial demands. Research has demonstrated that a careful recycling of water is the only feasible means as yet available for expanding the supply of usable water. Further research is being done to determine whether or not present systems of recycling water are compatible with minimum health standards or consistent with the latest scientific knowledge Results of this research have significance for every citizen in Texas.

Water Recharge Project: A study is underway to determine the economic feasibility of pumping large volumes of playa lake water into the Ogallala fresh water formation of the High Plains of Texas. Due to the rapid depletion of water in the High Plains area it is necessary that the conservation of all available water be practiced. Economic underground storage of playa water and/or imported water in the depleted portion of the Ogallala formation would benefit the domestic, industrial and agricultural interests of this and other areas.

Drought Relief: Drought relief and increased summer rainfall for certain areas of the State resulted from the successful application of a new method for seeding warm clouds. This meteorological research will provide critical assistance during the dry months for any part of the state where a drought condition exists.

Conversion of Mesquite to Usable Protein Food: A method is under development for the conversion of mesquite and other cellulose waste products into cattle feed. The State of Texas and its citizens will, if this project is successful, be able to enjoy the elimination of much environmental pollution caused by these wastes and reap the economic benefits gained from the conversion of wastes into cash assets.

Enhancement of Recreational Resources of the Texas Coast: Studies on the decay of a bay system to hypersaline conditions and its effects on the bay's productivity (birds, fish and crustaceans) will result in information useful to sportsmen and vacationers on the lower Texas coast. These data will be valuable in developing the lower Texas coast as a resource for recreation. Vacationers along the Texas Gulf Coast will be able to enjoy enhanced recreation as a result of corrective measures taken through the detailed examination of the causes of fish-kills. Studies on the health and diseases of marine and freshwater animals in Texas' coastal waters have produced data upon which the corrections are based.

. . . To Protect the Environment and Its Peoples

Control of Air Pollution from Cotton Gins: Due to the expense and limitations of present air pollution abatement equipment, the cost of ginning cotton would advance 30% to 40% if present methods are used to meet air pollution control regulations to be effective by February 1973. An investigation is underway to find a more economical means of emission control to avoid a cost increase that would force Southwest cotton fiber costs to a point beyond being competitive with synthetics and imported fibers.

Insecticide Pollution: Maintenance of the natural aquatic ecological balance in standing and running waters in Texas is important to everyone, but is of special interest to those people living adjacent to the waters, those who depend on these sources for drinking water, and those who use them for recreation. Just as surely, insecticides are of critical importance to agricultural interests. Often the interests are in conflict. Research into the extent of pollution resulting from currently used insecticides, as well as research resulting in the development of non-polluting insecticides, is reducing the level of conflict, and has as its final objective a final settlement.

Marine Environmental Studies: The prevention of marine environmental pollution will be significantly strengthened because of a method derived for predicting pollutant spreading off the Texas Coast. This will directly affect the enhancement of the Gulf Coast as a resource for industry and recreation.

Protection from Hurricanes: Organized research funds have financed extensive studies of hurricane damage to both industrial and residential areas along the Gulf Coast. These studies have resulted in the establishment of new standards for building construction in those areas. The end result could well be the saving of many human lives as well as millions of dollars when the Gulf Coast is subjected to disastrous hurricanes. Hurricane paths can be predicted by computer simulation. Since hurricane prediction has been relatively inaccurate in the past, it seems more reasonable to express the probability of landfall in different areas as 80%, 40%, 10%, etc., rather than simply designating a single point. After further testing, this technique should be of invaluable aid to residents, industry, and business interests along the Texas Gulf Coast.

A Message from the Commissioner . . .

At the request of the Coordinating Board, Texas College and University System, its select Advisory Committee on Organized Research undertook an examination of the role of Organized Research in Texas.

The examination has considered the relationship of research to teaching and learning, to the quality of academic programs, and to the needs of the state and its citizens.

We believe the report has statewide significance for Texas higher education and are pleased to make it available to the Texas academic community and other interested citizens as one of the Coordinating Board's Study Paper series.

The Coordinating Board staff expresses appreciation to the members of the Advisory Committee on Organized Research for their important contribution to the work of the Board.

BEVINGTON REED
Commissioner of Higher Education

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